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Type D personality and life event stress: The mediating effects of social support and negative social relationships

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Abstract

Background and Objective: Type D personality has been associated with increased perceptions of stress. As Type D individuals have been noted to report lower social support and greater perceptions of negativity in social interactions, this study examined if the association between Type D personality and life events stress was mediated by these social relationships.

Design: A cross-sectional design.

Methods: Undergraduate students (N = 197) completed questionnaires assessing Type D personality, social support, negative social relationships, and life events stress.

Results: Unadjusted analyses revealed that Type D individuals perceived their life events to be significantly more stressful than non-Type D individuals. Type D individuals also reported increased perceptions of negative social relationships and lower social support. Finally, the association between Type D personality and life events stress was mediated by perceptions of negative social relationships. However, when controlling for the main effects of negative affectivity and social inhibition, Type D was not significantly associated with social relationship or life events variables. Further, effects appeared to be primarily driven by negative affectivity.

Conclusion: These results support recent findings in the Type D literature that have identified null effects of Type D when controlling for negative affectivity.

Key Words: Type D personality, life event stress, social support, negative social relationships, stress

Introduction

Type D personality is characterised by increased levels of both negative affectivity (NA) and social inhibition (SI), with Type D individuals likely to experience an array of negative emotions, while simultaneously inhibiting the expression of these emotions in social interactions to avoid disapproval from others (Denollet, 2005). Over the past two decades, research has continually found Type D personality to predict adverse health-related outcomes, primarily in cardiac populations (Denollet, Pedersen, Vrints, & Conraads, 2006; Denollet et al., 1996; Denollet, Vaes, & Brutsaert, 2000; Martens, Mols, Burg, & Denollet, 2010; Angélique A Schiffer, Pedersen, Widdershoven, & Denollet, 2008; A. A. Schiffer, Smith, Pedersen, Widdershoven, & Denollet, 2010). More recently, Type D personality has been associated with a myriad of inauspicious physical and mental health states in both the general population (Allen, Wetherell, & Smith, 2019; De Fruyt & Denollet, 2002; Jellesma, 2008; Kupper & Denollet, 2014; Smith et al., 2018; Stevenson & Williams, 2014; Van Den Broek, Smolderen, Pedersen, & Denollet, 2010), and in non-cardiac patient populations (cancer, chronic pain, tinnitus, neurological disease) (Barnett, Ledoux, Garcini, & Baker, 2009; Dubayova et al., 2013; Kim, Nho, & Nam, 2018; Mols, Thong, van de Poll-Franse, Roukema, & Denollet, 2012; Strober, 2017; Zhang et al., 2016).

Several mechanisms have been posited to facilitate the relationship between Type D personality and adverse health. Indirect mechanisms have propounded the engagement in negative health behaviours as potential mediators of this relationship. For example, Type D personality has been associated with a range of unhealthy behaviours including smoking, unhealthy eating, physical inactivity and poor adherence to medical treatments (Gilmour & Williams, 2012; Williams, Abbott, & Kerr, 2016; Williams, O'Connor, Grubb, & O'Carroll, 2011; Williams et al., 2008; Wu & Moser, 2014). In addition, direct physiological mechanisms including aberrant cardiovascular and cortisol responses to acute stress (Bibbey, Carroll, Ginty,

& Phillips, 2015; Howard, Hughes, & James, 2011; O'Leary, Howard, Hughes, & James, 2013; O'Riordan, Howard, & Gallagher, 2019), increased diurnal cortisol output (Molloy, Perkins-Porras, Strike, & Steptoe, 2008; Whitehead, Perkins-Porras, Strike, Magid, & Steptoe, 2007) and pro-inflammatory activity (Denollet et al., 2009; Denollet, Vrints, & Conraads, 2008; Jandackova, Koenig, Jarczok, Fischer, & Thayer, 2017) have also received considerable support.

A further line of research has suggested that the relationship between Type D personality and adverse health may be facilitated via increased perceptions of stress, with several studies identifying that Type D individuals report greater perception of stress (Allen et al., 2019; Polman, Borkoles, & Nicholls, 2010; Smith et al., 2018; Williams & Wingate, 2012). Increased perceptions of stress are posited to influence health outcomes by perturbing physiological processes (e.g. autonomic, neuroendocrine, immune systems). This psychophysiological mechanism is premised on the theory of allostatic load, whereby exposure to chronic stress is propounded to disrupt mind-body regulatory systems, engendering an increased vulnerability to disease (McEwen, 1998, 2005). This increased perception of stress continually reported by Type D individuals is likely to pertain to their highly socially inhibited nature.

Social relationships are imperative factors influencing stress appraisal and coping. According to the stress buffering hypothesis, supportive social relationships are protective against the adverse effect of stress on health (Cobb, 1976; Cohen, 2004; Cohen & McKay, 1984; Cohen & Wills, 1985). More specifically, the buffering hypothesis posits that the perceived availability of others to provide the necessary resources may redefine the potential harm posed by a particular stressor, and thus enhances one's perceived ability to cope with imposed demands, thwarting environmental situations from being perceived as highly stressful (Cohen & Wills, 1985). In contrast, negative social relationships have been noted to

amplify the pathogenic impact of stress on physical and mental health outcomes (Cranford, 2004; Fiore, Becker, & Coppel, 1983; Ingersoll-Dayton, Morgan, & Antonucci, 1997; Rauktis, Koeske, & Tereshko, 1995). The stress exacerbation hypothesis postulates that negative social relationships may potentiate perceptions of stress and in turn exacerbate the pathogenic influence of stress on health (Rook, 1984). Thus, both supportive and negative social relationships may influence health outcomes by modifying the appraisal of stressful life events.

Type D individuals have been repeatedly found to report lower levels of social support (Ginting, van de Ven, Becker, & Naring, 2016; Polman et al., 2010; Sararoudi, Sanei, & Baghbanian, 2011; Shao, Yin, & Wan, 2017; Staniute et al., 2015; Williams et al., 2008), which have been found to increase their perception of stress (Williams & Wingate, 2012). Given that perceived social support is often not representative of actual social support, and is dependent on the cognitive appraisal of the recipient regarding the quality and accessibility of social support (Burg et al., 2005; Mankowski & Wyer, 1997), this perception of low social support is likely to be owing to a cognitive bias of interpersonal interpretation amongst Type D individuals. Additionally, this cognitive bias of interpersonal interpretation amongst Type D individuals has been posited to promote greater perception of negativity (perceived threat, anticipated distress and difficulty forming verbal responses) during hypothetical social interactions (Grynberg, Gidron, Denollet, & Luminet, 2012; Howard, O'Riordan, & Nolan, 2018). Thus, it is reasonable to postulate that not only are Type D individuals thwarted from the beneficial buffering effect of social support, but their biased perceptions by which they perceive negativity from others may engender maladaptive stress appraisal. Therefore, given that negative social relationships (stress exacerbation) and lower social support (no stress buffering), are postulated to result in increased perceptions of stress, which in turn is likely to disrupt mind body regulatory systems and promote adverse health (allostatic load), these social relationships may

be a preceding factor engendering increased perceptions of stress, and subsequently, negative health outcomes for Type D individuals.

Traditionally, Type D personality was analysed as a dichotomous typology, with participant's scoring above the established cut-off point (>10) on both subcomponents (NA and SI) classified as Type D and the remaining as non-Type D (Denollet, 2005). However, research has suggested that Type D may be better represented as a continuous variable based on the product of the SI and NA subscales, than as a dichotomous variable (Ferguson et al., 2009). Analyses using the continuous Type D construct (NA×SI) allows for the possibility to test for main effects using the continuous "Type D score". Furthermore, Type D personality is posited to consist of more than the presence of NA and SI and is suggested to be a synergistic effect of both constructs combined, (Denollet, 2005; Kupper & Denollet, 2007, 2014). Thus, Type D personality should predict outcomes above and beyond the effects of NA and SI independently. Analyses controlling for NA and SI separately, is therefore the most appropriate analytic method of determining the predictive utility of Type D personality. Prior research that have begun to control for the individual effects of NA and SI have observed null findings for Type D personality (Akram et al., 2018; Coyne et al., 2011; Grande et al., 2011; Stevenson & Williams, 2014; Williams, O'Connor, Grubb, & O'Carroll, 2012). Therefore, analyses in the current study will be conducted using the traditional dichotomous typology and will be subsequently replicated using the continuous interaction terms. Furthermore, all analyses will be conducted whilst controlling for the individual effects of NA and SI.

Considering the above evidence, the present study has three key aims. Firstly, this study will identify if Type D personality is associated with *both* an increased number and perception of life events stress in a student sample. Apart from one prior study (Allen et al., 2019), previ-

ous research has primarily examined the association between Type D personality and perceptions of stress, omitting the *quantity* of stressful life events experienced (Polman et al., 2010; Smith et al., 2018; Williams & Wingate, 2012). Furthermore, while previous research has primarily examined the association between Type D personality and generalised perceptions of everyday life stress, the current study extends these finding by examining perceptions of stress in relation to life events using a stressful life events scale specifically tailored for students. Secondly, the current study will investigate if social support (instrumental and emotional) and perceptions of negative social relationships (perceived rejection and hostility) mediate the association between Type D personality and life events stress (frequency and perceived stressfulness). Finally, the current study will examine if Type D personality has predictive utility when treated as both a dichotomous and dimensional variable, and when controlling for the main effects of NA and SI.

Methods

Participants

The sample consisted of 197 psychology undergraduate students, 140 (71.1%) female, with a mean age of 20.95 years (*SD* = 4.56). All participants were recruited via the University's online research participation system. In exchange for their participation, participants were provided with course credits. This study was approved by the University of Limerick's research ethics committee. Furthermore, all participants provided written informed consent prior to participating and were debriefed on completion of the study. A total of 25 participants (12.7%) were missing data on one or more study variables. Missing data was excluded using excluded cases pairwise. Furthermore, a G-power analysis indicated that a sample of N $\geq$ 138 was required to detect medium effects (p = .05, f^2 =0.15) with a power of .95.

Design

The present study employed a between-subjects design. The main independent variable was Type D personality. The dependant variables included both the total number of stress life events experienced and the perceived stressfulness of these events. Mediating variables included two measures of negative social relationships (perceived rejection and perceived hostility from others) and two measures of social support (emotional and instrumental support).

Negative Life Events Measure

The 36-item Life Events for Students Scale (Clements & Turpin, 1996; Linden, 1984) was used to measure both the number of stressful life events experienced by participants over the past year and the perceived stressfulness of these life events. This scale is composed of stressful life events that students may have encountered over the past year. Examples of items on the scale include; 'Failing a Course', 'Death of a Parent', 'Major Car Accident', 'Pregnancy', *et cetera*. Participants were required to indicate the number of stressful life events they had experienced over the past year. Furthermore, in line with several prior studies (Gallagher, O'Riordan, McMahon, & Creaven, 2018; Karatekin, 2018; Nikolova, Bogdan, Brigidi, & Hariri, 2012; Swartz, Knodt, Radtke, & Hariri, 2015), participants were required to rate the subjective impact of events by indicating the perceived stressfulness of each event they had experienced on a scale ranging from 1 (Not At All) to 4 (Very). This scale is tailored to suit the needs of students within third level education rather than the general public and had been previously employed in similar student samples (Gallagher et al., 2018).

Type D Personality

Type D personality was measured using the 14-item Type D scale (Denollet, 2005). The DS14 measures both negative affectivity (NA; 7 items) and social inhibition (SI; 7 items). Examples of items measuring negative affectivity include 'I am often irritated' and 'I often

feel unhappy'. Examples of items measuring social inhibition include 'I am a closed kind of person' and 'I often feel inhibited in social interactions'. Participants were required to respond to all items on a 5-point Likert scale (0 = 'False' to 4 = 'True'). Scores on both NA and SI subscales can range from 0-28. Participants scoring ≥ 10 on both subscales are classified as having Type D personality. However, research suggests that Type D personality may be more accurately represented as a dimensional rather than a categorical construct (Ferguson et al., 2009). Thus, a continuous Type D construct was also computed as the product of SI and NA subscales (Howard & Hughes, 2013; Howard et al., 2011; Howard et al., 2018). The DS14 shows good internal consistency with a Cronbach's α > .86 reported for both subscales (Denollet, 2005). In the present study, the Cronbach's α was .85 and .86 for SI and NA subscales respectively, indicative of high internal consistency. From our sample, 76 individuals were identified as Type Ds and 116 as non-Type Ds.

Negative social relationships

The social distress scale (Cyranowski et al., 2013) was used to measure perceptions of hostility and rejection from others. The social distress scale is composed of 16 items; eight measuring perceived hostility and eight measuring perceived rejection. Participants were required to rate on a 5-point Likert scale (1 = 'Never' to 5 = 'Always') how often people in their life treat them in the manner described by the questionnaire items. Items measuring perceptions of rejection include 'Act like they can't be bothered by me or my problems' and 'Avoid talking to me'. Examples of items measuring perceptions of hostility include 'Act in an angry way towards me' and 'Criticize the way I do things'. While the perceived rejection scale measures the perception of neglect and rejection from others, the perceived hostility scale measures the perception of ridicule, criticism and hostility from others. These scales have been found to display high internal consistency, with a Cronbach's α of .93 and .94 for

the perceived rejection and perceived hostility scale respectively (Cyranowski et al., 2013). In the current study, the Cronbach's α was .91 and .88 for the perceived rejection and perceived hostility scales respectively.

Social Support

Emotional and instrumental support were measured using two 8-item scales (Cyranowski et al., 2013). Participants were required to rate on a 5-point Likert scale (*1* = 'Never' to 5 = 'Always') how often they had experienced each of the eight statements during the past month. Examples of items measuring emotional support include 'I have someone who understands my problems' and 'I have someone to talk with when I have a bad day'. Examples of items measuring instrumental support include 'I have someone to take me shopping if I need it' and 'I have someone to help me if I'm sick in bed'. These scales have been found to display high internal consistency, with a Cronbach's α of .97 and .95 for the emotional support and instrumental support scale respectively (Cyranowski et al., 2013). In the current study, the Cronbach's α was .91 and .93 for the emotional support and instrumental support scales respectively.

Procedure

Data was collected as part of a larger study examining the influence of psychosocial factors on cardiovascular stress responsivity, which was collected between September 2017 and February 2019 (Brown, Creaven, & Gallagher, 2019). Once participants volunteered to take part in the study via the online research participation system, they received an automated e-mail detailing the time and location of the study. The study took place at the Health Psychology Laboratory at the University of Limerick. Upon arrival at the laboratory participants were provided with an information sheet and consent form. After signing the consent form, participants then completed the study questionnaires. On completion of the

questionnaires, participants were provided with a debriefing sheet, were thanked and left the laboratory.

Data analyses

The categorical Type D construct was computed using a cut-off of ≥ 10 on the SI and NA subscales (Denollet, 2005). Additionally, a continuous Type D construct was computed as the product of SI and NA subscales (Howard & Hughes, 2013; Howard et al., 2011; Howard et al., 2018; O'Leary et al., 2013; Whitehead et al., 2007). All analyses were initially conducted using the traditional Type D dichotomy and were all subsequently confirmed using the continuous Type D construct.

Independent sample *t*-tests were used to examine the difference between Type D and non-Type D individuals on levels of social support (emotional and instrumental), negative social relationships (perceived rejection and hostility) and life events stress variables (number and perceived stressfulness). Pearson's correlations were used to examine the association between all continuous variables. Multiple regressions were carried out to investigate if Type D personality was associated with social relationship and life events variables after controlling for the individual Type D continuous subcomponents (NA and SI). The effects of NA and SI were entered independently in step 1 and the dichotomous Type D typology (dummy coded; non-Type D = 0, Type D = 1) was then entered into the model at step 2. These multiple regressions were replicated, with the continuous Type D interaction term (NA×SI) entered into the model at step 2 in place of the Type D dichotomy.

Mediation analyses were used to examine if the associations between Type D personality (categorical and continuous) and life events stress (number and perceived stressfulness) were mediated via social support (emotional and instrumental) and negative social relationships (perceived rejection and hostility). These mediation analyses were subsequently replicated whilst controlling for NA and SI, to examine if mediation effects withstood adjustment for the

effects of the Type D continuous subcomponents. Thus, a total of 8 mediation analyses were conducted. Mediation analysis were conducted using Hayes (2017) PROCESS module for SPSS. A collinearity diagnostic revealed that there was no indication of multicollinearity between predictor and mediator variables in the mediation models, with all VIF < 10 (Largest = 1.87) and all tolerance statistics > .2 (Lowest = .54).

Results

Demographic and Descriptive Statistics

Mean and Standard deviation scores for NA×SI (*M* = 136.6, *SD* = 118.10), emotional support (*M* = 33.82, *SD* = 5.21), instrumental support (*M* = 30.03, *SD* = 6.57), perceived hostility (*M* = 15.52, *SD* = 5.15), perceived rejection (*M* = 15.4, *SD* = 5.06), total life events (*M* = 8.00, *SD* = 3.85) and perceived life events stress (*M* = 20.05, *SD* = 11.49) are in line with those previously reported elsewhere (Cyranowski et al., 2013; Gallagher et al., 2018; O'Riordan et al., 2019). See Table 1 for descriptive statistics.

The sample was predominately female undergraduate students, 140 (71.1%) female, with a mean age of 20.95 years (*SD* = 4.56). Seventy-six participants (39.6%) were classified as having Type D personality, fifty-one Type Ds were female (67.1%). Females reported greater levels of emotional support, $t(192) = 2.14$, $p = .03$, and lower levels of perceived hostility $t(192) = 2.62$, $p = .01$. There were no other gender differences on any other study variables.

As seen in table 2, an increased perception of hostile social relationships was associated with a greater number of, and perception of, stressful life events. Similarly, increased perceptions of rejection was also associated with a greater number and perception

of stressful life events. There was no significant association between social support (emotional or instrumental) and stressful life events variables.

Categorical Analyses

Type D individuals reported significantly lower levels of emotional, $t(188) = 4.88$, $p < .001$, and instrumental, $t(187) = 2.58$, $p = .01$, social support. Additionally, Type D individuals reported significantly greater perceptions of hostility, $t(188) = 4.26$, $p < .001$, and rejection, $t(187) = 4.42$, $p < .001$, from others. Although there was no significant difference between Type D and non-Type D individuals on the number of stressful life events experienced, $t(184) = 1.02$, $p = .31$, Type D individuals perceived their life events to be significantly more stressful, $t(174) = 2.77$, $p = .006$.

In multiple regression analyses, the effects of NA and SI were entered independently in step 1 and the dichotomous Type D typology was then entered into the model at step 2. At step 1, NA was associated with lower levels of emotional support, $b = -.33$, $t = -4.68$, $p < .001$, and greater perceptions of hostility, $b = .42$, $t = 5.82$, $p < .001$, and rejection, $b = .44$, $t = 6.17$, $p < .001$, from others. Additionally, NA was associated with a greater number of, $b = .27$, $t = 3.40$, $p < .001$, and perception of, $b = .33$, $t = 4.09$, $p < .001$, life events stress. SI was associated with lower levels of emotional, $b = -.27$, $t = -3.92$, $p < .001$, and instrumental support, $b = -.18$, $t = -2.27$, $p = .02$.

At step 2, NA remained significantly associated with emotional support, $b = -.35$, $t = 4.42$, $p < .001$, perceived rejection, $b = .45$, $t = 5.62$, $p < .001$, perceived hostility, $b = .41$, $t = 5.00$, $p = .003$, total life events, $b = .29$, $t = 3.26$, $p = .001$ and perceived life events stress, $b = .33$, $t = 3.52$, $p = .001$. Although the association between SI and emotional support remained significant, $b = -.30$, $t = 3.70$ $p = .01$, the association between SI and instrumental support become non-significant $b = -.16$, $t = -1.75$, $p = .08$. No significant effects emerged for the

dichotomous Type D typology on social relationship or life events variables in step 2 of the model (See table 3).

Unadjusted mediation analyses revealed that although there was no significant total effect of Type D personality on number of stressful life events, b = .46, t = .79, p = .43, there was a significant indirect effect via perceived hostility, b =.41, 95% BCa CI [.0305, .9551], and perceived rejection, b =.53, 95% BCa CI [.0164, 1.3055], with Type D individuals reporting a greater perception of hostility and rejection from others, resulting in an increased reporting of stressful life events.

Additionally, the total effect of Type D personality on perceived life events stress was significant, b = 4.39, t = 2.53, p = .01. Furthermore, the effect of Type D on perceived life events stress was significantly mediated via perceived hostility, b = 1.19, 95% BCa CI [.1299, 2.7823], and perceived rejection, b = 1.91, 95% BCa CI [.2272, 4.7718], with greater perceptions of hostility and rejection leading to an increased perception of life events stress amongst Type D individuals. Additionally, the direct effect of Type D personality on perceived life events stress became non-significant, b =.2.08, t = 1.14, p = .26, indicating complete mediation. Figure 1 shows this mediation pathway.

Follow-up analyses revealed no significant direct or indirect effects of the dichotomous Type D typology on either total life events or perceived life events stress after controlling for NA and SI.

Dimensional Analyses

All significant unadjusted main effects using the categorical construct were confirmed using the continuous Type D interaction term (NA×SI) in correlational analyses. Similar associations were observed for both individual subcomponents, with both SI and NA associated with lower levels of social support and greater perceptions of negative social

relationships, and NA associated with an increased number and perception of life events stress (See Table 2 for correlations).

In multiple regression analyses, the effects of NA and SI were entered independently in step 1 and the continuous Type D interaction terms was then entered into the model at step 2. Results for step 1 are reported above.

At step 2, NA was significantly associated with emotional support, b = -.42, t = 3.14, p = .002, perceived rejection, b = .41, t = 2.98, p = .003, perceived hostility, b = .44, t = 3.14, p = .002, total life events, b = .41, t = 2.69, p = .01 and perceived life events stress, b = .36, t = 2.30, p = .023. Similarly, the association between SI and emotional support remained significant at step 2, b = -.38, t = 2.57, p = .01. However, the association between SI and instrumental support become non-significant b = .04, t = .22, p = .83. Similar, to regression models using the dichotomous Type D typology, no significant effects emerged for the continous Type D interaction terms (NA×SI) on social relationship or life events variables in step 2 of the model (See table 3).

Unadjusted mediation analyses using the continuous Type D interaction term (NA×SI) revaled a signifcant total effect of NA×SI on perceived life events stress , b = .02, t = 3.28, p = .001, and a significant indirect effect of NA×SI on perceived life events stress via perceived hostility, b = .01, 95% BCa CI [.0003, .0140], and perceived rejection, b = .01, 95% BCa CI [.0003, .0244], with greater perceptions of hostility and rejection leading to an increased perception of life events stress amongst those with greater continuous Type D scores. Although there was no significant total effect of NA×SI on number of stressful life events, b = .003, t = 1.29 p = .20, there was a significant indirect effect via perceived hostility, b =.002, 95% BCa CI [.0001, .0048], with increased perceptions of hostile social relationships resulting in a greater number of total life events. There was no significant direct

effects of NA×SI on total life events, b =.0004, t = .13, p = .90, or perceived life events stress, b =.01, t = 1.46, p = .15, indicating complete mediation.

However, in adjusted models controlling for the effects of NA and SI, there was no significant direct or indirect effects of NA×SI on total life events or perceived life events stress.

Discussion

Unadjusted analyses indicated that while Type D individuals did not report an increased number of life events stress, they perceived these events as significantly more stressful than non-Type D individuals. Moreover, Type D individuals also reported lower levels of social support and increased perceptions of negative social relationships. The association between Type D personality and life event stress (number and perceived stressfulness) was not mediated by social support; rather it was mediated by increased perceptions of negative social relationships. However, these results were not replicated using either the continuous Type D interaction term (NA×SI) or the dichotomous Type D typology whilst controlling for the constituent elements of Type D personality (NA and SI). Furthermore, our findings indicated that the effects observed for Type D were primarily driven by the NA subcomponent.

While previous studies have primarily found associations between Type D personality and increased perceptions of generalised everyday life stress, (Polman et al., 2010; Smith et al., 2018; Williams & Wingate, 2012), the current study extends these findings by examining perceptions of stress in relation to specific life events. Our unadjusted main effect analyses indicated that while Type D individuals do not experience a greater amount of stressful life events, they perceived events to be significantly more stressful. Additionally, prior studies that have examined the association between Type D personality and perceptions of stress have not examined if results were confirmed whilst controlling for

the individual Type D subcomponents (Allen et al., 2019; Polman et al., 2010; Smith et al., 2018; Williams & Wingate, 2012) . The findings from the current study indicate that Type D personality does not have predictive utility for life events stress above and beyond the individual Type D subcomponents. In fact, while null findings were observed for Type D, NA was found to be significantly associated with an increased number and perception of life events stress.

Previous studies have continually found Type D personality to be associated with diminished social support and increased perception of negativity in social interactions (Ginting et al., 2016; Grynberg et al., 2012; Howard et al., 2018; Polman et al., 2010; Sararoudi et al., 2011; Shao et al., 2017; Staniute et al., 2015; Williams et al., 2008; Williams & Wingate, 2012). In fact, diminished levels of social support has been noted as a key mediator of the association between Type D personality and increased perceptions of stress (Williams & Wingate, 2012). However, prior studies have not examined if these associations withstood adjustment for the individual effects of NA and SI. Our findings indicate that the direct effect of Type D on social relationship variables, as well as the indirect effect of Type D on life events via social relationship variables are non-significant after controlling for the individual Type D subcomponents. Once again, the NA subcomponent emerged as a significant predictor of both emotional social support and perceptions of negative social relationships, while null effects were observed for Type D personality.

These results coincide with more recent findings in the Type D literature, showing null effects when analysing Type D as a dimensional construct and controlling for the individual subcomponents (Akram et al., 2018; Coyne et al., 2011; Grande et al., 2011; Stevenson & Williams, 2014; Williams et al., 2012). Type D personality is posited to consist of more than the mere presence of NA and SI and is suggested to be a synergistic effect of both constructs combined (Denollet, 2005; Kupper & Denollet, 2007, 2014). However, our

findings suggest that the effects observed for Type D are not driven by a synergetic interaction, but instead by the NA subcomponent. Similarly, more recent findings have also suggested that NA may be the key subcomponent, driving the relationship between Type D personality and a range of self-reported and objective health outcomes (Akram et al., 2018; Conden, Leppert, Ekselius, & Aslund, 2013; Stevenson & Williams, 2014; Wang et al., 2018; Wang et al., 2016; Williams et al., 2012). Thus, future research should employ the analytical approach used in the current study to identify if Type D has predictive utility above the NA trait alone, particularly when examining self-reported health outcomes.

The current study is not without its limitations. Firstly, our sample consisted of undergraduate students of a young age, with specific sample characteristics. Additionally, our measurement of stressful life events was specific to a student sample. Thus, the generalisability of our findings to other cohorts and patient populations is limited. However, the examination of health samples in relation to the Type D personality is important as we can identify important health-predictive associations before the onset of disease. Given that Type D personality itself arose in the cardiac literature, after disease onset, it is important to examine the construct in samples free from disease and the confound that illness introduces, particularly in relation to self-reported health outcomes. Finally, given that the results of the current study are based on a cross-sectional design, conclusions regarding cause and effect cannot be inferred. Thus, future research should confirm the above effects amongst other cohorts and patient populations using longitudinal designs.

In sum, the current study examined the relationship between Type D personality, social relationships and life events stress in a healthy sample, using both the traditional categorical approach and the more recent dimensional methods of analysing Type D. Unadjusted analyses indicated that Type D individuals reported lower levels of social support, increased perceptions of negative social relationships and greater perceptions of life

events stress in comparison to their non-Type D counterparts. Furthermore, the association between Type D personality and life events stress was significantly mediated via increased perceptions of negative social relationships. However, adjusted analyses controlling for NA and SI revealed that that effects observed for Type D were primarily driven by the NA subcomponent and not by the synergetic interaction. These findings accentuate the importance of controlling for the individual effects of NA and SI when examining the association between Type D personality and health outcomes.

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Table 1.

Descriptive statistics of personality, social relationships and life events variables

Personality/Life Events and Social Relationships	Range	Mean	*SD*	Cronbach's α
Type D (Continuous)	0 - 675	136.6	118.10	N/A
Social Inhibition	0 - 26	10.32	5.77	.85
Negative Affect	1 - 27	11.90	5.71	.86
Emotional Support	13 - 40	33.82	5.21	.91
Instrumental Support	8 - 40	30.03	6.57	.93
Perceived Hostility	8 - 36	15.52	5.15	.88
Perceived Rejection	8- 32	15.4	5.06	.91
Total Life Events	1 - 18	8.00	3.85	N/A
Perceived Life Events Stress	2 - 56	20.05	11.49	N/A

Table 2

Correlations among Type D Personality, Social Relationships, and Life Events Variables.

	1	2	3	4	5	6	7	8	9
1. Type D	-	.84**	.79**	-.47**	-.24**	.37**	.44**	.11	.26**
2. Social Inhibition	-	-	.45**	-.42**	-.22**	.23**	.30**	.02	.14
3. Negative Affect	-	-	-	-.44**	-.15**	.47**	.49**	.23**	.33**
4. Emotional Support	-	-	-	-	.40**	-.40**	-.56**	-.02	-.13
5. Instrumental Support	-	-	-	-	-	-.07	-.27**	-.03	-.08
6. Perceived Hostility	-	-	-	-	-	-	.50**	.21**	.28**
7. Perceived Rejection	-	-	-	-	-	-	-	.20**	.30**
8. Total Life Events	-	-	-	-	-	-	-	-	.93**
9. Perceived Life Events Stress	-	-	-	-	-	-	-	-	-

****$p < 0.01$ level**

Table 3.

Regression analyses

	ES			**IS**			**PH**			**PR**			**TLE**			**PLES**		
Variable	*β*	t	*p*	*β*	T	*p*	*β*	t	*p*	*β*	t	*p*	*β*	t	*p*	*β*	t	*p*
Step 1																		
NA	-.33	-4.68	< **.001**	-.09	-1.07	.29	.42	5.82	< **.001**	.44	6.17	< **.001**	.27	3.40	**.001**	.33	4.09	< **.001**
SI	-.27	-3.92	< **.001**	-.18	-2.27	**.02**	.05	.62	.54	.10	1.40	.16	.10	-1.22	.22	.00	-.002	.99
Step 2: Dichotomous Type D typology																		
NA	-.35	4.42	< **.001**	-.07	.73	.47	.41	5.00	< **.001**	.45	5.62	< **.001**	.29	3.26	**.001**	.33	3.52	**.001**
SI	-.30	3.70	< **.001**	-.16	-1.75	.08	.03	.37	.71	.11	1.37	.17	-.07	-.81	.42	-.001	-.010	.99
Type D	.05	.57	.57	-.50	-.49	.63	.03	.36	.72	-.03	-.31	.75	-.05	-.53	.60	.002	.018	.99
Step 2: Continuous Type D interaction term (NA × SI)																		
NA	-.42	3.14	**.002**	.04	.28	.78	.44	3.14	**.002**	.41	2.98	**.003**	.41	2.69	**.01**	.36	2.30	**.023**
SI	-.38	-2.57	**.01**	-.04	-.22	.83	.06	.40	.69	.06	.41	.68	.06	.34	.74	.03	0.20	.84
(NA × SI)	.17	.80	.42	-.24	-.99	.32	.03	-.13	.90	.61	.28	.78	-.26	-1.05	.30	-.06	-.23	.82

Note: ES = Emotional support, IS = Instrumental Support, PH = Perceived hostility, PR = Perceived rejection, TLE = Total life events, PLES = Perceived life event stress.

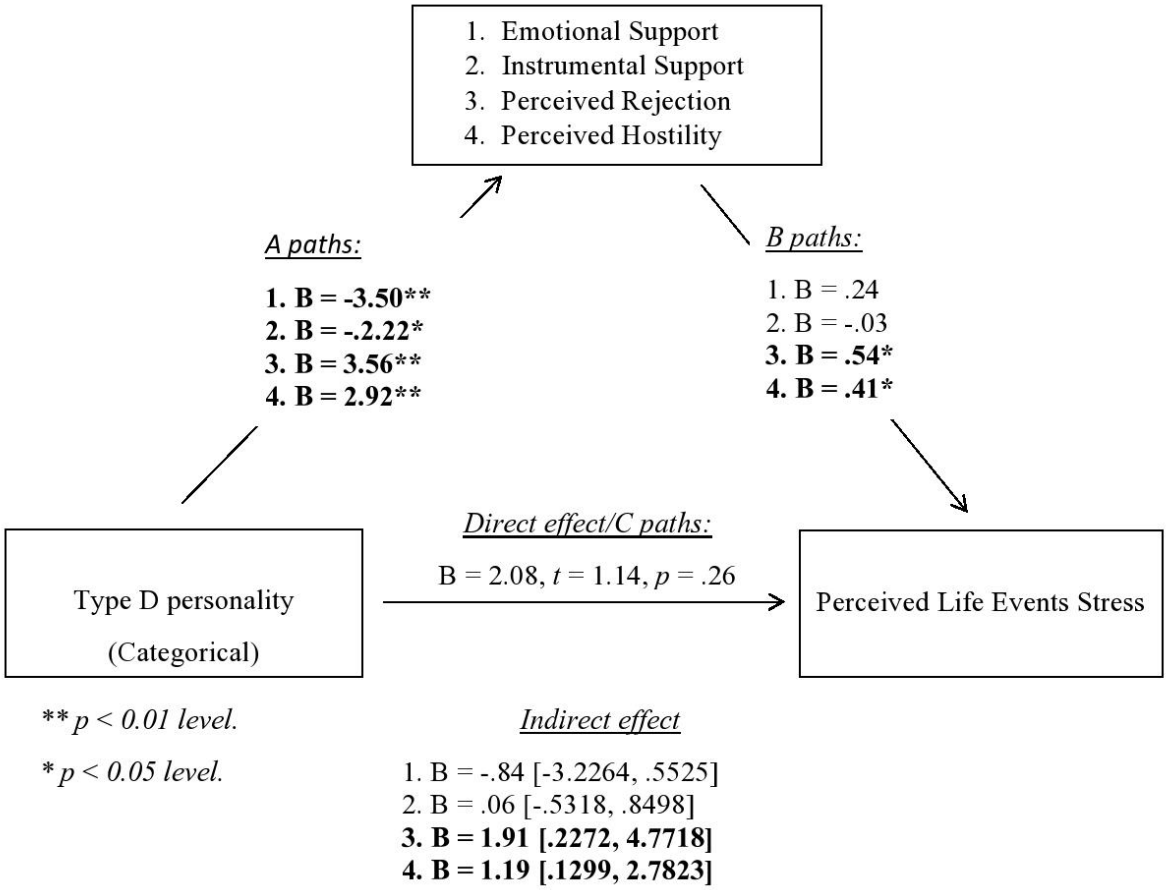

Figure 1. Unadjusted mediation path diagram: Indirect effects of Type D personality (categorical) on perceived life events stress via the social relationship mediation variables. Significant effects are highlighted in bold text.